
CREDIT Research Paper**No. 08/03**

Aggregate and Sector Import Price Elasticities for a Sample of African Countries

by

Chris Jones

Abstract

This paper applies panel data methods to a simple imperfect substitutes model to estimate import demand elasticities for ten African countries. The elasticities are estimated at three levels of aggregation. Firstly, we generate aggregate elasticities for each country. Secondly, we use interactive dummy variables to create estimates for 16 sectors defined by the World Customs Organisation (WCO). Finally, we estimate elasticities for each of the 94 2-digit product lines defined by the Harmonised System (HS). In total there are 10 aggregate estimates, 158 estimates for the 16 WCO sectors; and 911 estimates at the 2-digit level. Using Fixed-Effects, the aggregate estimates do not differ significantly from unity. However, as we move to different levels of aggregation the estimates have much more variability. In general, import demand appears more elastic in sectors that have relatively high levels of domestic production or where there are exports.

JEL Classification: F14, O55

Keywords: Imports, Import Demand Elasticities, Africa

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Acknowledgements

Helpful comments were received from my supervisors, Oliver Morrissey and Doug Nelson.

1 INTRODUCTION

The estimation of import demand functions is a long established area of analysis in International Economics, and price elasticity estimates are increasingly important as they are used in a wide range of empirical applications. This importance has grown in tandem with the use of CGE models (which require elasticities) in studies of world trade, such as to monitor the effects of trade policy reforms negotiated under the auspices of the WTO, and with the growth of world trade (and the associated demand for analysis) itself. Elasticity estimates are required for analysing the effects of trade, whether on employment and debt rescheduling and terms-of-trade gains from tariff liberalisation. In addition, estimates at the product/sector level have been used in the new wave of political economy models that have attempted to analyse the cross-industry-pattern of protection. Grossman and Helpman (1994) use a modified Ramsey pricing rule to evaluate this cross-sector-pattern. Their analysis suggests that politically organised sectors with inelastic demand will obtain positive levels of protection. Consequently, estimates of import price elasticities are a valuable input to trade policy analysis for developing countries. Nevertheless, few estimates exist for African countries, especially at the product level. The principal aim of this paper is to fill the gap for some African countries.

Previous estimates of aggregate price elasticities of demand have used time-series data and have been based on an imperfect substitutes model. We will discuss this model in more detail below. Recently however, researchers have used a production function approach to estimate elasticities at a far more disaggregated level, see Kohli (1991). A World Bank study by Kee, Nicita and Olarreaga (2005) used panel data to derive over 300,000 [bilateral/country] product elasticity estimates.

In this paper we use the imperfect substitutes model with [country] panel data to estimate import price elasticities for ten African Countries: Algeria, Cameroon, Central African Republic (CAR), Ethiopia, Egypt, Gabon, Kenya, Madagascar, Tanzania and Uganda. Utilising a balanced panel of industry data covering the period 1993-2004, we estimate aggregate import demand elasticities for each country using OLS and fixed effects estimators. We then extend the aggregate model by including interactive dummy variables to generate import demand elasticities for 16 sectors and 94 industries as defined Harmonised System (HS) used by the World Customs Organisation (WCO).

The results of the pooled OLS regressions suggest that the aggregate import elasticity of demand for each African country is fairly elastic, with the coefficient estimates generally greater than unity.¹ These aggregate estimates may be upwardly biased and are typically reduced by the fixed-effects estimates that take into account the specific nature of the industries included. To estimate the elasticities at a more disaggregated level we integrate sector/industry interactive dummy variables with the aggregate model and we find the presence of considerable variation. Some sectors/industries report elasticities greater than 2, whilst others report estimates less than 0.5 (in absolute value). The majority of the results reported tend to be statistically significant at the 1 percent level. To verify that the estimates are or are not statistically different from unity (i.e. to permit inference of elastic, unit elastic or inelastic) the 95 percent confidence intervals for each estimate are reported.

The remainder of this paper is set out in the following way. Part 2 discusses the imperfect substitutes model used and the production function approach used by Kee, Nicita and Olarreaga (2005). Parts 3 and 4 present the empirical specification and data construction respectively. Part 5 reports, on a sectoral basis, the elasticity estimates for each country. Finally, in Part 6 we conclude.

2 THE IMPERFECT SUBSTITUTES MODEL

Previous studies of import demand elasticities have generally used an imperfect substitutes model; see Sawyer and Sprinkle (1999) for a comprehensive survey. For this reason, we estimate a form of the model using panel data.

The Imperfect Substitutes Model

For convenience a simple two country framework is assumed. The demand for country i 's imports from the rest of the world can be represented as:

$$M_i^D = f(Y_i, PM_i, PD_i) \quad (1)$$

Where M_i^D denotes the quantity of country i 's import demand; Y_i denotes the level of money income in country i ; PM_i denotes the domestic currency price paid by importers in country i ; and PD_i denotes the price of all domestically produced goods within

¹ I will refer to all elasticity estimates in terms of their absolute value. Where estimates less than 1 are regarded as inelastic, and estimates greater than 1 are regarded as elastic.

country i . This specification is in accordance with conventional demand theory, where the consuming country is postulated to maximise utility subject to a budget constraint. The resulting demand function for imports thus represents the quantity demanded as a function of the level of money income in country i ; the imported goods own price; and the price of domestic substitutes. Assuming there is no money illusion the sum of the partial derivatives $f_y + f_{PD} + f_{PM} = 0$. This homogeneity requirement is often expressed by dividing the demand function by PD_i to obtain:

$$M_i^D = f(Y_i / PD_i, PM_i / PD_i) \quad (2)$$

The supply of country i 's imports from the rest of the world can be represented as:

$$M_i^S = g(PM_i^*, PD^*) \quad (3)$$

Where M_i^S denotes the supply of imports from the rest of the world to country i ; PM_i^* denotes the price of the rest of the world's exports; and PD^* denotes the foreign currency price of all domestically produced goods in the rest of the world. The specification of the supply function indicates that the quantity supplied from the rest of the world is a positive function of the own price and a negative function of the price of domestically produced goods in the exporting country.

In equilibrium, import demand to country i equals export supply to country i from the rest of the world:

$$M_i^D = M_i^S \quad (4)$$

Equation (4) ensures that both the supply and the demand for imports in the imperfect substitutes model is, at least in theory, simultaneous. The implicit assumption being that prices move to equate supply and demand in each time period. Despite this simultaneity researchers have often interpreted the supply of exports to be perfectly elastic. This allows single equation methods of estimation for the import demand function.

As already stated, the imperfect substitutes model and its variants have provided the general theory for the application of time series data. Nevertheless, since the 1970's the quality of trade data has improved and panel datasets that include information on hundreds of industries/sectors have become available. To utilise this data Kee, Nicita and

Olarreaga (2005) have used a production function approach introduced by Kohli (1991). They generate in total 315,451 import demand elasticities, with a sample average of -1.67. These estimates, generated by a translog specification, are based on a model of a GDP function that includes as arguments prices and factor endowments. We do not use the production function approach in our analysis. This is because there does not appear to be any studies in the existing literature that use the imperfect substitutes model with panel data. We therefore fill this gap. This decision is based on the models simplicity and data limitations. The next section discusses the empirical specification.

3 EMPIRICAL SPECIFICATION

Four models will be used to estimate import demand elasticities for each of the ten countries. The first two specifications estimate an aggregate elasticity for each country using Ordinary Least Square (OLS) and, to take into account industry specific effects, we use fixed effects via the Within Groups Estimator. As we only have data on imports by volume and value (from which unit prices are derived) and on tariffs, (1) is approximated as:

$$\ln Q_{it} = \alpha_{it} + \beta \ln[P_{it}(1 + t_{it})] + \varepsilon_{it} \quad (5)$$

Where the subscripts i and t are industries and time respectively; Q is the logarithm of imports measured in quantities; $P(1+t)$ is the logarithm of the tariff-inclusive price² and ε_{it} is the error term. The model is estimated in log-linear form so the coefficient β_{it} can be interpreted as the import price elasticity of demand. The null hypothesis is that β_{it} is negative. This suggests, like any demand function, that as the tariff-inclusive price rises import demand falls. Unlike the imperfect substitutes model expressed above there are no effects accounted for by income and domestic prices. When the model is estimated using OLS these effects are subsumed into the error term.³ This may bias the estimates: by estimating the model with the Within Groups estimator we attempt to model these factors via fixed effects.

If the elasticity estimates are between zero and unity in absolute value, import demand can be described as inelastic. In other words import demand is fairly unresponsive to changes in price. Analogously, if the elasticity estimate is greater than unity import

² Note here that t is the average tariff measured as a ratio (e.g. a tariff of 10% is $t = 0.1$).

³ We have experimented with GDP at constant prices. For each country the estimate is statistically insignificant.

demand can be described as elastic. Elastic estimates suggest that countries may be more prone to import surges resulting from tariff liberalisation. For this reason the elasticity estimates have important policy implications.

To generate elasticities for each of the 16 WCO sectors we include in equation (5) interactive dummy variables. The 16 sectors are identified in Table 1 below. The model takes the following form:

$$\ln Q_{it} = \alpha_{it} + \beta [\ln P_{it} (1 + t_{it}) \times I] + \varepsilon_{it} \quad (6)$$

The parameter β and the variable I are now in matrix notation. The matrix I has 16 columns representing the 16 sector dummies identified in Table 1.1. The tariff-inclusive price is interacted with the 16 sector dummies. This means that the estimated vector β contains the elasticity estimates for each of the 16 sectors. The 16 interactive dummy variables account for sector heterogeneity just like the fixed effects estimates. The null hypothesis is that each elasticity (β estimate) is negative and statistically significant. If the estimates demonstrate variability with each other, price changes in some sectors may have a greater impact on import demand relative to other sectors. This has additional policy implications in terms of tariff liberalisation and its effects on import surges.

Finally, using the same approach above, we use 94 interactive dummy variables for each industry defined by the HS (see Appendix A1). The coefficient estimate for each of the 94 interactive dummy variables is the corresponding elasticity for each of the 94 industries. In the next section we discuss data use and construction.

4 DATA METHODOLOGY

The data used is taken from the COMTRADE database and uses the Harmonised System. For each country we create a balanced panel across time and industries. Industries are defined at the 2-digit level⁴. Appendix A1 contains a nomenclature for each of the 94 2-digit industries⁵. For each of these industries we generate data on import quantities, average tariffs and unit prices with the latter two variables combined to construct the

⁴ The time periods used for each country are: Algeria (92-03), Cameroon (95-04), CAR (93-03), Ethiopia (97-03), Egypt (94-99), Gabon (96-04), Kenya (97-00), Madagascar (93-04), Tanzania (95-04), and Uganda (94-04).

⁵ In appendix A1 Table A1 there are 96 2-digit industries, a closer look shows that industries 77 and 91 are redundant.

tariff-inclusive price. This tariff-inclusive price is then interacted with the 15/94 sector/industry dummy variables to estimate the sector/industry elasticities. Each variable is constructed as follows:

1. Import Quantity

The import quantity⁶ data is available at the 6-digit level. This is transformed into a 2-digit classification. An example of this transformation, using Tanzanian data for industry *01 Live Animals* in 2004, is shown in Table A2.1 in Appendix A2. There are nine 6-digit product lines within industry 01. The quantity data for each of these 6-digit product lines is summed to form the total import quantity for industry *01 Live Animals*. This process is replicated for each year and for every other 2-digit industry shown in the nomenclature in Appendix A1. For the majority of 2-digit industries the quantity data is measured in kilograms, but for some sectors the measurement is defined by the number of items or by litres. For this reason the quantity data for each industry can be interpreted as industry-specific. This should not be a problem because the quantity definitions are consistent across the years for each country⁷.

2. Average Tariffs

The tariff data is available at the 8-digit level. This is transformed into a 2-digit classification by constructing the average tariff for each 2-digit industry. An example, using Kenyan data for industry 05 in 1994, is shown in Table A2.2 in Appendix A2. There are 20 product lines with corresponding tariffs. To find the average tariff for the 2-digit industry we just take the average across the 20 product lines. In this case we are left with an average of 40.15. This process is replicated for each 2-digit sector and for each year⁸. Obviously there are drawbacks to this measure. In some cases the average might be biased, caused by product lines with very ‘high’ or ‘low’ values. Calculating the Coefficient of Variation (CV) for each 2-digit industry does confirm this; but for the majority of sectors the CV is fairly low. We did experiment by creating some exceptions

⁶ Import Quantity is defined as the bilateral flow from the whole world. We do not consider bilateral flows with individual countries.

⁷ For all of the countries there is missing quantity data for various 2-digit industries. These industries are omitted from the subsequent analysis. The missing sectors are: Algeria: 91, 93, 97; Cameroon: 91, 97; CAR: 01, 02, 03, 04, 05, 06, 07, 08, 10, 11, 12, 13, 14, 15, 26, 41, 43, 45, 46, 47, 50, 60, 71, 75, 89, 91, 97; Ethiopia: 71, 91, 97; Egypt: 91, 97; Gabon: 71, 91, 97; Kenya: 91, 97; Madagascar: 91, 97; Tanzania: 91, 97; Uganda: 91, 97.

⁸ We do not have data available on tariffs for each year. For example for Kenya tariff data is available for 1994, 2001, 2002, and 2004. So the tariffs for the periods 1995-2000 and 2003 are assumed to be the 1994 and 2002 tariffs respectively. In other words the data we do have tends to be when reported tariffs are different-usually post liberalisation.

using the Algerian data in 1993 (this resulted in an additional sixty 2-digit sectors) but the method used to calculate the exceptions did not apply well to the other years available and fared even worse when applied to the other countries. To reduce the complexity the exceptions caused, the analysis is conducted for the same 96 industries for all the countries.

3. Unit Prices

Import prices for each 2-digit industry are not available so, as is common in the literature, we use the unit price defined as the import value (in US Dollars) divided by the import quantity. For each 2-digit sector we have data on import values in current prices, which are transformed into constant prices using the World Bank's Import Value Deflator (base year of 2000). We then divide the deflated import value for each 2-digit sector by its corresponding quantity. In general the unit price is the price per kilogram, but as stated above not all quantities are reported in kilograms. For this reason, like the quantity data, the unit price is industry specific.⁹

4. Sector/Industry Dummy Variables

In the subsequent analysis we estimate 16 sector elasticities and 94 industry elasticities. The 16 sectors have been chosen in accordance with the World Customs Organisation (WCO)¹⁰. The 94 industries are defined by the HS. We have to categorise the 96 industries into these 16 sectors. This 'split' can be seen in the Nomenclature in Appendix A1. The 16 sectors are identified in Table 1 below.

⁹ It is important to recognise that it is the average unit price used. This simplifies a more complex approach that could use quantity weights.

¹⁰ For details see: http://www.wcoomd.org/ie/En/Topics_Issues/topics_issues.html.

This website lists all of the 2-digit HS industries. Each of the 2-digit industries is divided into 21 Sections. From these Sections I create 17 'Sectors' (with abbreviated descriptions). I have therefore decided to bring together some Sections to form bigger Sectors. For example: Sector 2: Vegetable Products includes Section II: *Vegetable Products* and Section III: *Animal or Vegetable Fats and Oils and their Cleavage Products; Prepared Edible Fats; Animal or Vegetable Waxes*. The other Sectors that are a product of two Sections include, in addition to Sector 2, Sector 6, Sector 7 and Sector 10. In reality it is only possible to estimate elasticities for 16 Sectors due to missing quantity data for Sector 17: Works of Art and Antiques. Fortunately this Sector only has one 2-digit industry within it. Appendix A1 shows which 2-digit industries are within each of the 16 Sectors.

Table 1: The 16 Sector Classification

Sector	Sector Description
1	Live Animals
2	Vegetable Products.
3	Beverages & Tobacco.
4	Mineral Products.
5	Chemicals.
6	Rubber & Hides.
7	Woods & Paper Products.
8	Textiles.
9	Footwear, Headgear etc.
10	Stones, Pearls, Glass etc.
11	Base Metals.
12	Machinery & Electrical Equipment.
13	Vehicles & Transport Equipment.
14	Precision Instruments.
15	Arms & Munitions.
16	Miscellaneous Manufactures.

The ‘split’ means that there are 16 dummy variables used. For example: the 2-digit industries 01-05 form sector dummy 1 *Live Animals*. Included in sector dummy 1 are industries 01-05 which receive a value of 1 whilst the other sectors 06-97 receive a value of 0. Likewise, the 2-digit industries 06-15 form sector dummy 2 *Vegetable Products*. Included in sector dummy 2 are industries 06-15 which receive a value of 1 whilst the other sectors 01-05 and 16-97 receive a value of zero. This process is replicated for the remaining sector dummies. In the subsequent analysis these dummy variables are interacted with the tariff-inclusive price to estimate elasticities for each of the 16 sectors. To estimate elasticities for each of the 94 industries defined by the HS we create 94 dummy variables for each 2-digit industry. Each dummy is then interacted with the tariff-inclusive price to estimate each industry’s elasticity. In the next section we discuss the results in detail.

5. RESULTS

The full results for each country are reported in Appendix A3. For most of the countries the coefficient estimates are statistically significant at the 1 percent level. The R-squared values are usually greater than 0.40, suggesting that the simple specification explains quite a lot of the variation within the data. This section presents and discusses, on aggregate and on a sector-by-sector basis, the results, with comparisons to other studies where relevant.

Aggregate Elasticity

Table 2 reports the results for the aggregate elasticity model, estimated by OLS, for each of the ten countries. All of the estimates are significant at the 1 percent level. For all of the countries the reported elasticities are greater than unity, with only Tanzania's confidence interval including the unit elasticity value of one. The largest estimate of -1.532 is Madagascar compared to the smallest estimate of -1.053 for Tanzania. These results imply that import demand in African countries is fairly elastic. In other words as prices fall import demand will rise by a greater than proportional amount. This suggests that import surges from price reductions are quite likely, but it is debatable as to whether the elasticity estimates are large enough to imply this possibility. In comparison to the estimates by Kee, Nicita and Olarreaga (2005) the estimates seem to be larger (typically, their estimate is below the lower bound of our confidence interval), even though both demonstrate the elastic nature of import demand in Africa. In contrast, estimates of the aggregate elasticity from other studies are even greater. For example Umo (1981) estimates an aggregate elasticity for Ethiopia of -3.05 compared to our estimate of -1.347.

As OLS estimates may be biased we re-estimate using fixed effects to take account of specific (unobserved) sector characteristics; results are reported in Table 3. For each country the reported estimate is smaller than its corresponding OLS estimate. For seven out of the ten countries the reported elasticity is less than unity. However, out of these seven countries only three - Algeria, Kenya and Tanzania - have confidence intervals that do not include unity. These results imply that the response of import demand to changes in price is less elastic than the estimates obtained via OLS. For this reason import surges would appear to be less likely. In addition, the lower estimates are closer in comparison to Kee *et al.* (2005); for Egypt, Ethiopia and Gabon the estimates are almost identical.

Table 2: Aggregate Elasticity Estimates (OLS)

Country	OLS	95% Conf Interval		Kee ^[a]	Arize ^[b]	Faini ^[c]	Umo ^[d]	Tegene ^[e]
Algeria	-1.204***	-1.302	-1.107	-1.13				
CAR	-1.444***	-1.592	-1.295	-1.15	-1.06			
Cameroon	-1.207***	-1.316	-1.098	-1.21	-1.05	-1.87		
Egypt	-1.410***	-1.555	-1.264	-1.14				
Ethiopia	-1.347***	-1.488	-1.206	-1.09			-3.05	-0.88
Gabon	-1.388***	-1.538	-1.238	-1.11	-0.90	-1.33		
Kenya	-1.148***	-1.287	-1.010	-1.14		-1.48		-2.12
Madagascar	-1.532***	-1.634	-1.430	-1.12				
Tanzania	-1.053***	-1.154	-0.952	-1.09				
Uganda	-1.224***	-1.326	-1.122	-1.08	-1.3			

Notes:*** indicates significant at the 1 percent level; [a] is Kee *et al.* (1995) based on a 3-digit classification; [b] Arize Afifi (1987);

[c] Faini, *et al.*(1988); [d] Umo (1981); [e] Tegene (1989).

Table 3: Aggregate Fixed Effects Estimates

Country	FE	95% Conf Interval		Kee ^[a]	Arize ^[b]	Faini ^[c]	Umo ^[d]	Tegene ^[e]
Algeria	-0.825***	-0.957	-0.693	-1.13				
CAR	-0.906***	-1.043	-0.768	-1.15	-1.06			
Cameroon	-0.968***	-1.038	-0.898	-1.21	-1.05	-1.87		
Egypt	-1.001***	-1.146	-0.857	-1.14				
Ethiopia	-1.037***	-1.207	-0.866	-1.09			-3.05	-0.88
Gabon	-1.072***	-1.198	-0.946	-1.11	-0.90	-1.33		
Kenya	-0.817***	-0.922	-0.713	-1.14		-1.48		-2.12
Madagascar	-0.970***	-1.101	-0.838	-1.12				
Tanzania	-0.816***	-0.874	-0.757	-1.09				
Uganda	-0.948***	-1.026	-0.871	-1.08	-1.3			

Notes:*** indicates significant at the 1 percent level; [a] is Kee *et al.* (1995) based on a 3-digit classification; [b] Arize Afifi (1987);

[c] Faini, *et al.*(1988); [d] Umo (1981); [e] Tegene (1989)

Accounting for industry heterogeneity using fixed effects reduces the bias caused by OLS. For this reason the estimates using fixed effects are considered more reliable. For the remainder of this section we report the elasticity estimates for the 16 sectors and 94 industries reported in Table 1 and Appendix A1 respectively. Although the models are estimated using OLS, industry heterogeneity is accounted for by the sector-specific dummy variables.

1. Live Animals (01-05)

The results for the *Live Animals* sector are reported in Table 4. Compared with the aggregate elasticities estimated above the elasticity for each country is considerably higher. For every country the reported elasticity is considerably greater than unity. This is especially so for Cameroon -3.266; Uganda -2.210; Madagascar -2.109; and Tanzania -2.042. The estimate of -0.174 for Egypt is statistically insignificant. These results suggest that import demand for the *Live Animals* sector is highly responsive to changes in price. Changes in unit prices and average tariffs in this sector are therefore likely to have effects on the countries trade balance with a likelihood of import surges in this sector. These results should probably not come as much of a surprise. With African comparative advantage predominantly agricultural, the competition between domestic production and foreign imports must make demand more sensitive to price. A study by Nguyen and Bhuyan (1977) using data for India between 1957-1969 estimated the elasticity for the Food sector at -2.903.

Table 4: Live Animals

Country	Sector 1 Elasticity	95% Confidence Interval	
Algeria	-1.808***	-2.308	-1.308
CAR			
Cameroon	-3.266***	-3.877	-2.655
Egypt	-0.174	-0.806	0.458
Ethiopia	-1.752***	-2.320	-1.183
Gabon	-1.352***	-1.706	-0.999
Kenya	-1.582***	-2.453	-0.712
Madagascar	-2.109***	-2.347	-1.871
Tanzania	-2.042***	-2.412	1.673
Uganda	-2.210***	-2.615	1.805
Average	-1.811		

Notes: *** indicates significant at the 1 percent level

2. Vegetable Products (06-15)

The results for Sector 2: *Vegetable Products* are reported in Table 5. Like Sector 1 we again observe relatively elastic estimates. This is again hardly surprising considering the sector is agricultural. The highest elasticity is estimated at -2.449 for Madagascar compared with the lowest estimate of -1.506 for Kenya. Again the potential effects on the countries trade balance from tariff liberalisation are likely to be quite striking. Import demand for this sector appears to be relatively sensitive to prices.

Table 5: Vegetable Products

Country	Sector 2 Elasticity	95% Confidence Interval	
Algeria	-2.370***	-2.668	-2.071
CAR			
Cameroon	-1.562***	-1.790	-1.334
Egypt	-2.372***	-2.704	-2.041
Ethiopia	-1.879***	-2.232	-1.526
Gabon	-2.106***	-2.354	-1.858
Kenya	-1.506***	-1.831	-1.182
Madagascar	-2.449***	-2.649	-2.250
Tanzania	-2.320***	-2.729	-1.912
Uganda	-1.953***	-2.338	-1.568
Average	-2.104		

Notes: *** indicates significant at the 1 percent level

3. Beverages & Tobacco (16-24)

The results for Sector 3: *Beverages & Tobacco* are reported in Table 6. All of the estimates are statistically significant at the 1 percent level and average -1.229. They are in general less elastic than the results for Sector 1 and Sector 2 but for most of the countries the estimated elasticities are greater than unity. For Kenya and Uganda, the two countries that report estimates below one in absolute value, unity is included within the 95 percent confidence intervals. These results indicate that tariff liberalisation is likely to have a greater than proportionate impact on imports but the potential for an import surge is less likely than for Sector 1 and Sector 2.

The results for this sector are also qualitatively similar to past studies for other developing countries. For example, Nguyen and Bhuyan (1977) estimate a price elasticity of -1.623 for the Food, Beverages and Tobacco sector in Pakistan; Gafar (1981) and Melo and Vogt (1984) estimate price elasticities for Beverages at -1.01 and -1.033 for Jamaica and Venezuela respectively.

Table 6: Beverages & Tobacco

Country	Sector 3 Elasticity	95% Confidence Interval	
Algeria	-1.577***	-1.853	-1.301
CAR	-1.651***	-1.916	-1.386
Cameroon	-1.135***	-1.314	-0.956
Egypt	-1.412***	-1.609	-1.215
Ethiopia	-1.309***	-1.560	-1.059
Gabon	-1.035***	-1.268	-0.803
Kenya	-0.991***	-1.211	-0.771
Madagascar	-1.251***	-1.434	-1.068
Tanzania	-1.086***	-1.428	-0.744
Uganda	-0.842***	-1.002	-0.683
Average	-1.229		

Notes: *** indicates significant at the 1 percent level

4. Mineral Products (25-27)

The pattern of results for Sector 4: *Mineral Fuels*, reported in Table 7, is fairly similar to the results for Sector 2. The estimates for each country differ somewhat from the average estimate of -1.535. Madagascar again reports a relatively elastic estimate of -2.473. This strong effect is in direct contrast to the relatively lower estimates of -0.751 and -0.818 for Gabon and Tanzania. To a certain degree the results for this sector are quite surprising. Fuel is generally regarded, in particular in developed countries, as an inelastic good - unresponsive to changes in price. For this reason it is interesting that most of the reported elasticities are greater than unity in absolute value. There could be a multitude of reasons for this. Firstly some of the countries are major producers; for example hydrocarbons account for roughly 30% of GDP in Algeria (CIA World Factbook). It might be easier for end-users in these countries to substitute imports for domestic output. Secondly the aggregate figures may hide some product lines that do face inelastic demand. Thirdly, there is often some degree of State intervention in fuel imports and distribution, price distortions and shocks may make import demand appear more elastic than market demand.

Previous studies have also found relatively elastic estimates. For example Bautista (1977) reported an estimate for the Philippines of -1.206; Nguyen and Bhuyan (1977) reported an estimate for Pakistan of -1.570; and Sundararajan and Bhole (1989) reported an estimate of -1.084 for India.

Table 7: Mineral Fuels

Country	Sector 4 Elasticity	95% Confidence Interval	
Algeria	-1.338***	-1.541	-1.135
CAR	-1.265***	-1.830	-0.699
Cameroon	-2.045***	-2.387	-1.702
Egypt	-1.534***	-1.674	-1.394
Ethiopia	-2.106***	-2.676	-1.536
Gabon	-0.741**	-1.413	-0.068
Kenya	-1.321***	-2.262	-0.380
Madagascar	-2.473***	-3.025	-1.921
Tanzania	-0.818***	-1.399	-0.236
Uganda	-1.708***	-2.632	-0.785
Average	-1.535		

Notes: *** indicates significant at the 1 percent level

5. Chemicals (28-38)

The next set of results, reported in Table 8, is Sector 5: *Chemicals*. For each of the countries reported, the point estimate is less than unity in absolute value. In addition, for only three countries - Egypt, Ethiopia and Tanzania - does the 95 percent confidence interval include unity. There is little variance across the countries, with the highest estimate of -0.752 reported for Tanzania, and the lowest (Uganda is statistically insignificant) of -0.531 reported for Kenya; this compares to an average overall of -0.637. With these consistent results it seems evident that import demand for chemicals is fairly inelastic. Tariff liberalisation in the Chemicals Sector, for the ten African countries analysed, is unlikely to cause a surge in imports. For this reason policy-makers may wish to freeze tariffs at their existing levels because the revenue gains may outweigh the small redistributive gains from liberalisation.

Table 8: Chemicals

Country	Sector 5 Elasticity	95% Confidence Interval	
Algeria	-0.653***	-0.880	-0.427
CAR	-0.678***	-0.941	-0.416
Cameroon	-0.705***	-0.943	-0.468
Egypt	-0.926***	-1.090	-0.761
Ethiopia	-0.664***	-1.019	-0.308
Gabon	-0.693***	-0.891	-0.496
Kenya	-0.531***	-0.804	-0.259
Madagascar	-0.612***	-0.759	-0.464
Tanzania	-0.752***	-1.041	-0.463
Uganda	-0.159	-0.372	0.053
Average	-0.637		

Notes: *** indicates significant at the 1 percent level

6. Rubber & Hides (39-43)

The results for Sector 6: *Rubber and Hides* are reported in Table 9. We again see a fairly mixed pattern across all of the countries. For six of the countries the elasticity estimate is greater than 2 in absolute value; with Kenya reporting the most elastic estimate of -2.298. The lowest estimate is -0.951 for Cameroon but even the 95 percent confidence interval for this country includes unity. These results suggest that changes in the tariff-inclusive price are likely to have a significant effect on import demand. Tariff liberalisation in this sector may lead to a surge in imports, although this result may be driven by the industry producing hides (the tanning industry); this is typically a sector with a strong domestic presence, and should have a higher import demand elasticity than the overall sector. Rubber, which is the major import in the sector, should have a lower import demand elasticity. Evidence for this can be seen when we examine the results for the individual industries via the 94 interactive dummy variables. Table A3.6 reports estimates for industry 40 *Rubber and Articles Thereof* and industry 41 *Raw Hides and Skins*. For convenience we report them in Table 10 below.

Table 9: Rubber & Hides.

Country	Sector 6 Elasticity	95% Confidence Interval	
Algeria	-2.261***	-2.871	-1.651
CAR	-1.128***	-1.674	-0.583
Cameroon	-0.951***	-1.518	-0.384
Egypt	-2.569***	-3.119	-2.019
Ethiopia	-2.346***	-3.011	-1.681
Gabon	-2.388***	-2.877	-1.898
Kenya	-2.822***	-3.954	-1.690
Madagascar	-2.298***	-2.671	-1.924
Tanzania	-1.410***	-2.480	-0.341
Uganda	-1.502***	-2.616	-0.387
Average	-1.968		

Notes: *** indicates significant at the 1 percent level

As can be seen the more disaggregated results fit the hypothesis. The elasticity estimates for industry 40 *Rubber and Articles Thereof* are positive for each country showing that price is very unresponsive to demand; whilst the results for industry 41 *Raw Hides and Skins* are consistently (except for Tanzania which is insignificant) greater than unity in absolute value. This is especially so for Ethiopia -4.502.

Table 10: Industries 40 and 41.

Country/ Sector	40	41
Algeria	1.725***	-1.492***
Cameroon	0.247*	-2.172***
CAR	0.704***	
Ethiopia	3.303***	-4.502***
Egypt	0.696***	-2.041***
Gabon	0.539***	-2.638***
Kenya	2.621**	-2.448***
Madagascar	0.932***	-2.230***
Tanzania	2.404***	-0.823
Uganda	1.596***	-1.806**

Notes: *** indicates significant at the 1 percent level

7. *Woods & Paper Products (44-49)*

The results for Sector 7: *Woods & Paper Products* are reported in Table 11 and are quite mixed. For most of the countries import demand is relatively elastic; but for the Central African Republic there is a highly inelastic estimate of -0.420. The largest estimate in absolute value is -2.268 for Algeria; this is far greater than the country average of -1.573. Sub-sectors may be important as in Sector 6: paper is typically imported, whereas many of the countries have a relatively strong domestic wood sector. For this reason the demand for wood should be more elastic than the demand for paper/paper products. Evidence for this is reported in Table 12 which reports the industry estimates obtained via the 94 industry dummies.

Table 11: Woods & Paper Products.

Country	Sector 7 Elasticity	95% Confidence Interval	
Algeria	-2.268***	-2.722	-1.815
CAR	-0.420**	-0.810	-0.030
Cameroon	-1.940***	-2.760	-1.121
Egypt	-2.520***	-3.470	-1.570
Ethiopia	-1.792***	-2.546	-1.039
Gabon	-1.775***	-2.362	-1.188
Kenya	-1.538***	-2.228	-0.849
Madagascar	-1.496***	-1.913	-1.079
Tanzania	-0.743***	-1.031	-0.454
Uganda	-1.242***	-1.706	-0.778
Average	-1.573		

Notes: *** indicates significant at the 1 percent level

The industry definitions are as follows: 44 *Wood Articles*, 45 *Cork*, 46 *Straw Manufactures*, 47 *Pulp of Wood*, 48 *Paper* and 49 *Printed Articles*. As can be seen, for each of the countries the estimates for industries 44-47 (industries that are more likely to

have a domestic presence) are fairly elastic; whilst the estimates for Paper and Printed Articles tend to be more inelastic.

Table 12: Industries 44-49.

Country/ Sector	44	45	46
Algeria	-3.574***	-3.445***	-1.363
Cameroon	-1.747***	-3.769***	-4.406***
CAR	-1.529***		
Ethiopia	-2.661***	-2.935***	-3.520***
Egypt	-1.861	-4.210***	-6.278***
Gabon	-0.999***	-2.789***	-3.385***
Kenya	-0.936***	-4.148***	-4.076***
Madagascar	-1.468***	-2.538***	-2.858***
Tanzania	-1.260***	0.726	-2.138***
Uganda	-1.336***	-2.606***	-3.984***

Country/ Sector	47	48	49
Algeria	-1.601***	-3.481	-0.754***
Cameroon	-0.254	1.293	0.141
CAR		1.732***	-0.112
Ethiopia	-1.669***	-2.286**	0.0231
Egypt	-1.243***	1.402	-1.029***
Gabon	-8.830***	1.810***	-0.172**
Kenya	1.184	-2.952	0.483**
Madagascar	-0.489***	2.394***	-0.0493
Tanzania	-0.731***	1.633	0.391***
Uganda	0.608	-0.979	0.203**

8. *Textiles and Garments (50-63)*

The textile industry is an important potential source of competitive advantage (Porter, 1990) for African countries, although inefficiencies and relatively high unit labour costs (compared to South and East Asia) mean this is rarely realised unless they benefit from trade preferences. Import demand tends to be fairly sensitive to prices although there are likely to be sub-sector differences as the potential to substitute imports for domestic products is generally less for textiles (which are mostly imported) than for garments (where there is domestic production). Evidence for this hypothesis is mixed when looking at the disaggregated results for the 94 industries in Appendix A3 - and might be country-specific. Nevertheless for each country the estimated demand is elastic with the average equal to -1.751. The highest estimate of -2.185 is for Gabon; whilst the lowest estimate is -1.144 for Ethiopia (Table 13). The potential for an import surge in this sector from tariff liberalisation is quite high suggesting that there will be a domestic lobby to protect domestic garment producers.

Table 13: Textiles.

Country	Sector 8 Elasticity	95% Confidence Interval	
Algeria	-1.684***	-1.937	-1.432
CAR	-2.073***	-2.354	-1.792
Cameroon	-1.980***	-2.316	-1.643
Egypt	-1.795***	-1.941	-1.649
Ethiopia	-1.144***	-1.589	-0.698
Gabon	-2.185***	-2.480	-1.890
Kenya	-1.757***	-2.142	-1.372
Madagascar	-1.354***	-1.625	-1.084
Tanzania	-1.498***	-1.858	-1.138
Uganda	-2.039***	-2.409	-1.669
Average	-1.751		

Notes: *** indicates significant at the 1 percent level

9. Footwear & Headgear etc (64-67)

The results for Sector 9: *Footwear & Headgear* are reported in Table 14. The elasticity estimates for each country are relatively elastic with an elasticity average across the ten countries equal to -1.974 which is even greater than the Live Animals sector. This is consistent with the likelihood of their being domestic production. The highest reported estimate is -2.546 for Egypt (a relatively industrialised sector which is likely to have a large domestic sector), whereas the lowest elasticity of -1.237 is estimated for Uganda (a country with a small and underdeveloped manufacturing sector). Out of the ten countries, only Ethiopia and Uganda do not include -2 in the confidence intervals while the confidence intervals for Egypt and Kenya (another country likely to have a significant domestic sector) include -3. This suggests that a 10 percent reduction in the tariff-inclusive price would lead to a 30 percent increase in import demand. For this sector price volatility caused by tariffs or unit prices could significantly alter the trade balance and significant import surges are a definite possibility.

Table 14: Footwear & Headgear etc.

Country	Sector 9 Elasticity	95% Confidence Interval	
Algeria	-1.987***	-2.296	-1.677
CAR	-2.048***	-2.324	-1.772
Cameroon	-1.764***	-2.081	-1.448
Egypt	-2.546***	-3.032	-2.060
Ethiopia	-1.439***	-1.817	-1.060
Gabon	-1.828***	-2.041	-1.614
Kenya	-2.421***	-3.192	-1.649
Madagascar	-2.246***	-2.513	-1.979
Tanzania	-2.222***	-2.800	-1.644
Uganda	-1.237***	-1.770	-0.705
Average	-1.974		

Notes: *** indicates significant at the 1 percent level

10. Stones, Pearls, Glass etc (68-71)

Mining comprises a high proportion of African GDP, and is typically a major export sector. Just like textiles, one would expect import demand to be fairly elastic because of domestic substitutes. However this substitutability may be less marked due to the type of end-user. For example, consumers of expensive jewellery may not be able to substitute as easily compared to firms that use mined materials as inputs into the production process. This hypothesis may be vindicated by the results. Although the estimates do appear to be relatively elastic for each country, none of the elasticities are near 2 in absolute value (Table 15). In fact most of the estimates are thinly spread around the average of -1.235; with Cameroon reporting the highest estimate of -1.543 and Egypt reporting the lowest estimate of -1.074.

Table 15: Stones, Pearls, Glass etc.

Country	Sector 10 Elasticity	95% Confidence Interval	
Algeria	-1.150***	-1.199	-1.101
CAR	-1.066***	-1.393	-0.739
Cameroon	-1.543***	-1.779	-1.307
Egypt	-1.074***	-1.153	-0.995
Ethiopia	-1.196***	-1.968	-0.425
Gabon	-1.094***	-1.422	-0.766
Kenya	-1.285***	-1.343	-1.227
Madagascar	-1.296***	-1.352	-1.241
Tanzania	-1.340***	-1.450	-1.231
Uganda	-1.307***	-1.398	-1.215
Average	-1.235		

Notes: *** indicates significant at the 1 percent level

11. Base Metals (72-83)

The elasticity results for Sector 11: *Base Metals* are reported in Table 16. With an average elasticity, with little variability, across countries of -1.898 the estimates are relatively elastic. This suggests that the trade balance for Base Metals could be affected by trade liberalisation or reductions in unit prices possibly caused by prices on the world market. However, for many countries some base metals are likely to be exports rather than imports. Interestingly the elasticity results for the disaggregated industries 82 *Tools* and 83 *Miscellaneous Articles of Base Metals* (presented in Appendix A3) are far lower than Base Metals industries 72-81.

Table 16: Base Metals.

Country	Sector 11 Elasticity	95% Confidence Interval	
Algeria	-1.729***	-2.014	-1.443
CAR	-2.057***	-2.297	-1.817
Cameroon	-1.728***	-1.978	-1.477
Egypt	-1.855***	-2.129	-1.580
Ethiopia	-2.050***	-2.391	-1.709
Gabon	-2.087***	-2.367	-1.807
Kenya	-1.933***	-2.355	-1.511
Madagascar	-2.098***	-2.322	-1.874
Tanzania	-1.539***	-1.896	-1.181
Uganda	-1.900***	-2.226	-1.575
Average	-1.898		

Notes: *** indicates significant at the 1 percent level

12. Machinery & Electrical Equipment (84-85)

The production of Machinery and Mechanical Appliances in Sub-Saharan African economies tends to be non-existent or very basic. These goods are likely to form a high proportion of imports because of the limited domestic supply. Demand arises mostly from public infrastructure projects, typically financed by aid, and capital investment by firms. In either case demand is likely to be insensitive to prices and to depend on the availability of export earnings (or aid) to pay for imports. For this reason the elasticity estimates should be between zero and -1. Table 17 provides the elasticity results for Sector 12: *Machinery & Electrical Equipment* for each country. As can be seen each of the estimates is statistically significant, but all have a positive sign. This is true when we look at the disaggregated estimates for industry 84 *Nuclear Reactors, Boilers, Machinery and Mechanical Appliances* and industry 85 *Electrical Machinery and Equipment*. This suggests that as import prices increase import demand follows suite implying that imported machinery and electrical equipment are Giffen Goods. This does seem unlikely, even if machinery and electrical equipment is hypothesised to be price inelastic.

It might be that aggregating together all of the machinery and electrical equipment into one sector might produce these perverse results. If there is a noticeable degree of processing within the sector, for example intermediate vs. final consumption goods, then the results may have been biased. A more complex analysis of the product lines within this sector may be needed to determine an appropriate elasticity for this sector for each country. It might be that demand is so inelastic at the product line level that we should assume a value of zero. Another possibility, plausible at least for those countries that are major recipients of aid, is that a significant proportion of imports in this sector is for public infrastructure projects and/or is aid financed – funding is made available so

quantity demanded is relatively independent of price. In such a situation, suppliers may be inclined to increase prices, generating the appearance of a positive import demand elasticity.

Table 17: Machinery & Electrical Equipment.

Country	Sector 12 Elasticity	95% Confidence Interval	
Algeria	0.874***	0.748	1.000
CAR	0.408***	0.252	0.564
Cameroon	0.438***	0.303	0.572
Egypt	0.436***	0.271	0.601
Ethiopia	1.344***	1.014	1.674
Gabon	0.479***	0.280	0.678
Kenya	0.219*	-0.009	0.447
Madagascar	0.560***	0.421	0.700
Tanzania	1.416***	1.095	1.736
Uganda	0.459**	0.083	0.836
Average	0.663		

Notes: *** indicates significant at the 1 percent level

13. Vehicles & Transport Equipment (86-89)

The results for Sector 13: *Vehicles & Transport Equipment* are reported in Table 18. As hypothesised for Sector 12 we expect the import demand elasticities to be relatively inelastic given the non-existence of a domestic sector and the importance of infrastructure investment. The estimates fit the hypothesis. The average elasticity across countries is -0.892. In addition, all countries except Egypt report a point estimate of less than unity in absolute value.

As is the case for other sectors above, past studies are in accordance with these results. Nguyen and Bhuyan (1977) report an estimate of -0.756 and -0.893 for Machinery and Transport for Bangladesh and India respectively; Gafar (1988) reports an estimate of -0.495 for Trinidad and Tobago.

Table 18: Vehicles & Transport Equipment.

Country	Sector 13 Elasticity	95% Confidence Interval	
Algeria	-0.777***	-0.913	-0.641
Cameroon	-0.873***	-0.977	-0.769
CAR	-0.730***	-1.035	-0.425
Egypt	-1.727***	-2.209	-1.245
Ethiopia	-0.996***	-1.288	-0.704
Gabon	-0.625***	-0.761	-0.488
Kenya	-0.882***	-1.145	-0.618
Madagascar	-0.799***	-0.982	-0.615
Tanzania	-0.582***	-0.727	-0.437
Uganda	-0.928***	-1.095	-0.761
Average	-0.892		

Notes: *** indicates significant at the 1 percent level

14. Precision Instruments (90-92)

The results for Sector 14: *Precision Instruments* are reported in Table 19. Demand for products in this sector should be fairly price inelastic due to their sophisticated nature and the sophistication of the likely buyer. However the elasticity results provide fairly mixed evidence for this. Most of the estimates include unity in the confidence interval with the highest elasticity of -2.005 reported for Kenya and the lowest elasticity of -0.782 reported for Ethiopia. These results imply that trade liberalisation is likely to cause larger import surges in some countries compared to others.

Table 19: Precision Instruments.

Country	Sector 14 Elasticity	95% Confidence Interval	
Algeria	-1.118***	-1.595	-0.640
Cameroon	-1.346***	-1.745	-0.948
CAR	-1.339***	-1.795	-0.882
Egypt	-1.094***	-1.562	-0.627
Ethiopia	-0.782***	-1.210	-0.354
Gabon	-0.956***	-1.329	-0.583
Kenya	-2.005***	-2.525	-1.486
Madagascar	-0.906***	-1.193	-0.620
Tanzania	-0.902***	-1.451	-0.354
Uganda	-1.340***	-1.832	-0.847
Average	-1.179		

Notes: *** indicates significant at the 1 percent level

15. Arms & Munitions (93)

The results for Sector 15: *Arms & Munitions* reported in Table 20, is not only interesting from a trade policy perspective but has important foreign policy implications (notwithstanding the possibility of under-reporting of imports in this sector). As can be seen the estimated elasticities vary considerably across countries. The elasticity estimates

for Egypt and Madagascar are approximately equal to -2.000 compared with the estimate for the CAR of -0.390. These results show that demand is more responsive to prices in some countries compared to others.

If the reported figures are purely government purchases these elasticities might be biased by the existing amount of arms available, the likelihood of conflict and the trade in illegal weapons. It is not evident that demand is more inelastic in countries with higher internal or external security concerns. The very elastic value for Egypt is not consistent with its geo-strategic position and the elastic value for Uganda is not consistent with being involved in conflict, while the inelastic value for Kenya is not consistent with its relatively good security position (crime may be high but it is not involved in conflict). It is easier to understand why Ethiopia, with internal security problems and involved in conflict, has inelastic demand whereas Tanzania, not involved in conflict and relatively secure, has a quite elastic value.

Table 20: Arms & Munitions.

Country	Sector 15 Elasticity	95% Confidence Interval	
Algeria			
Cameroon	-1.206***	-1.394	-1.019
CAR	-0.390***	-0.558	-0.223
Egypt	-2.071***	-2.452	-1.691
Ethiopia	-0.760***	-0.996	-0.524
Gabon	-0.993***	-1.088	-0.899
Kenya	-0.625***	-1.083	-0.167
Madagascar	-1.917***	-2.148	-1.686
Tanzania	-1.665***	-1.791	-1.539
Uganda	-1.510***	-1.770	-1.250
Average	-1.237		

Notes: *** indicates significant at the 1 percent level

16. Miscellaneous Manufactures (94-96)

The final sector to discuss is Sector 16: *Miscellaneous Manufactures*. The results for this sector are reported in Table 21. It is difficult to hypothesise any *a priori* for this sector because of its miscellaneous nature. Realistically we have to treat it as the aggregate of product-lines that have not made it into any of the other sectors above that could be classified as manufacturing. For this reason it would seem reasonable to assume that relatively inelastic demand elasticities are more likely to be present in this sector. This theory is generally borne out by the results. The average across all countries is -0.699 with only Egypt and Gabon reporting values greater than unity within their 95 percent confidence intervals.

Table 21: Miscellaneous Manufactures.

Country	Sector 16 Elasticity	95% Confidence Interval	
Algeria	-0.225	-0.518	0.068
Cameroon	-0.566***	-0.807	-0.326
CAR	-0.292	-0.715	0.131
Egypt	-0.947***	-1.172	-0.723
Ethiopia	-0.723***	-0.888	-0.558
Gabon	-1.174***	-1.434	-0.915
Kenya	-0.666***	-0.908	-0.424
Madagascar	-0.375**	-0.726	-0.023
Tanzania	-0.840***	-1.053	-0.627
Uganda	-1.180***	-1.320	-1.041
Average	-0.699		

Notes: *** indicates significant at the 1 percent level

Table 22: Price Sensitivity Ordering.

Sector	Sector Description	Average Elasticity
2	Vegetable Products.	-2.104
9	Footwear, Headgear etc.	-1.974
6	Rubber & Hides.	-1.968
11	Base Metals.	-1.898
1	Live Animals	-1.811
8	Textiles	-1.751
7	Woods & Paper Products.	-1.573
4	Mineral Products.	-1.535
15	Arms & Munitions.	-1.237
10	Stones, Pearls, Glass etc.	-1.235
3	Beverages & Tobacco.	-1.229
14	Precision Instruments.	-1.179
13	Vehicles & Transport Equipment.	-0.892
16	Miscellaneous Manufactures.	-0.699
5	Chemicals.	-0.637
12	Machinery & Electrical Equipment.	0.663

Summary

Table 22 reports the average elasticity across countries for each of the 16 sectors. There is a general ordering, in that sectors with relatively higher elasticity estimates are more likely to have some domestic capacity, and in particular export capacity. As can be seen, the estimates for Sector 2: *Vegetable Products* and Sector 1: *Live Animals* are at the top end of the sensitivity ordering. Sectors like Sector 5: *Chemicals* and Sector 13: *Vehicles & Transport* - that tend to have negligible domestic production and high import penetration, appear to be at the bottom of the ordering (most inelastic). These findings seem to accord well with economic theory and in essence vindicate the results. In

addition when considering the estimates for each of the 94 industries estimated via the 94 interactive dummy variables there is even more variation.

6. CONCLUSION.

This paper has estimated import demand elasticities for ten African countries. The empirical specification is based on the imperfect substitutes approach, which provides the theoretical motivation, although the data limitations restrict the variables included for estimation. Results are first presented for aggregate elasticities for each country using OLS and a fixed effects Within-Groups estimator. The results using fixed effects suggest that the aggregate price elasticity of import demand in each country is close to unity. This finding is in accordance with the results of Kee, Nicita and Olarreaga (2005). These results suggest that a proportional cut in tariffs across the board is unlikely to lead to a greater than proportional increase in imports. For this reason import surges may be unlikely.

The aggregate results hide the variance across products, which should be large, and this is addressed by including the 16/94 sectors/industries interactive dummy variables. The results on a sector-by-sector/industry basis show that the import price elasticities vary significantly. In general import demand appears more elastic in sectors that export or have significant domestic production and appears inelastic for sectors dominated by imports. This has implications for policy analysis in the context of trade liberalisation. As identified in the introduction, political economy considerations suggest that tariffs will be higher, or tariff reductions lower, in domestic sectors that have both the capacity and incentive to lobby for protection - this is often linked to a strong domestic presence. In addition sectors/industries with more elastic import demand will face higher tariffs/lower cuts due to higher efficiency losses (Ramsey Pricing).

Appendix A1: Nomenclature.

Table A1: Nomenclature.

Sector	Industry	Industry Description
Sector 1	01	Live animals.
	02	Meat and edible meat offal.
	03	Fish and crustaceans, molluscs and other aquatic invertebrates.
	04	Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included.
	05	Products of animal origin not elsewhere specified or included.
Sector 2	06	Live trees and other plants; bulbs, roots and the like; cut flowers and ornamental foliage.
	07	Edible vegetables and certain roots and tubers.
	08	Edible fruit and nuts; peel of citrus fruit or melons.
	09	Coffee, tea, maté and spices.
	10	Cereals.
	11	Products of the milling industry; malt; starches; insulin; wheat gluten.
	12	Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit; industrial or medicinal plants; straw and fodder.
	13	Lac; gums, resins and other vegetable saps and extracts.
	14	Vegetable plaiting materials; vegetable products not elsewhere specified or included.
	15	Animal or vegetable fats and oils and their cleavage products; prepared edible fats; animal or vegetable waxes.
Sector 3	16	Preparations of meat, of fish or of crustaceans, molluscs or other aquatic invertebrates.
	17	Sugars and sugar confectionery.
	18	Cocoa and cocoa preparations.
	19	Preparations of cereals, flour, starch or milk; pastry cooks' products.
	20	Preparations of vegetables, fruit, nuts or other parts of plants.
	21	Miscellaneous edible preparations.
	22	Beverages, spirits and vinegar.
	23	Residues and waste from the food industries; prepared animal fodder.
	24	Tobacco and manufactured tobacco substitutes.
Sector 4	25	Salt; sulphur; earths and stone; plastering materials, lime and cement.
	26	Ores, slag and ash.
	27	Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral waxes.
Sector 5	28	Inorganic chemicals; organic or inorganic compounds of precious metals, of rare-earth metals, of radioactive elements or of isotopes.
	29	Organic chemicals.
	30	Pharmaceutical products.
	31	Fertilisers.
	32	Tanning or dyeing extracts; tannins and their derivatives; dyes, pigments and other colouring matter; paints and varnishes; putty and other mastics; inks.
	33	Essential oils and resinoids; perfumery, cosmetic or toilet preparations.

	34	Soap, organic surface-active agents, washing preparations, lubricating preparations, artificial waxes, prepared waxes, polishing or scouring preparations, candles and similar articles, modelling pastes, "dental waxes" and dental preparations with a basis of plaster.
	35	Albuminoidal substances; modified starches; glues; enzymes.
	36	Explosives; pyrotechnic products; matches; pyrophoric alloys; certain combustible preparations.
	37	Photographic or cinematographic goods.
	38	Miscellaneous chemical products.
Sector 6	39	Plastics and articles thereof.
	40	Rubber and articles thereof.
	41	Raw hides and skins (other than fur skins) and leather.
	42	Articles of leather; saddlery and harness; travel goods, handbags and similar containers; articles of animal gut (other than silk-worm gut).
	43	Fur skins and artificial fur; manufactures thereof.
Sector 7	44	Wood and articles of wood; wood charcoal.
	45	Cork and articles of cork.
	46	Manufactures of straw, of esparto or of other plaiting materials; basket ware and wickerwork.
	47	Pulp of wood or of other fibrous cellulosic material; recovered (waste and scrap) paper or paperboard.
	48	Paper and paperboard; articles of paper pulp, of paper or of paperboard.
	49	Printed books, newspapers, pictures and other products of the printing industry; manuscripts, typescripts and plans.
Sector 8	50	Silk.
	51	Wool, fine or coarse animal hair; horsehair yarn and woven fabric.
	52	Cotton.
	53	Other vegetable textile fibres; paper yarn and woven fabrics of paper yarn.
	54	Man-made filaments.
	55	Man-made staple fibres.
	56	Wadding, felt and non-woven; special yarns; twine, cordage, ropes and cables and articles thereof.
	57	Carpets and other textile floor coverings.
	58	Special woven fabrics; tufted textile fabrics; lace; tapestries; trimmings; embroidery.
	59	Impregnated, coated, covered or laminated textile fabrics; textile articles of a kind suitable for industrial use.
	60	Knitted or crocheted fabrics.
	61	Articles of apparel and clothing accessories, knitted or crocheted.
	62	Articles of apparel and clothing accessories, not knitted or crocheted.
	63	Other made up textile articles; sets; worn clothing and worn textile articles; rags.
Sector 9	64	Footwear, gaiters and the like; parts of such articles.
	65	Headgear and parts thereof.
	66	Umbrellas, sun umbrellas, walking-sticks, seat-sticks, whips, riding-crops and parts thereof.
	67	Prepared feathers and down and articles made of feathers or of down; artificial flowers; articles of human hair.

Sector 10	68	Articles of stone, plaster, cement, asbestos, mica or similar materials.
	69	Ceramic products.
	70	Glass and glassware.
	71	Natural or cultured pearls, precious or semi-precious stones, precious metals, metals clad with precious metal and articles thereof; imitation jewellery; coin.
Sector 11	72	Iron and steel.
	73	Articles of iron or steel.
	74	Copper and articles thereof.
	75	Nickel and articles thereof.
	76	Aluminium and articles thereof.
	78	Lead and articles thereof.
	79	Zinc and articles thereof.
	80	Tin and articles thereof.
	81	Other base metals; cermets; articles thereof.
	82	Tools, implements, cutlery, spoons and forks, of base metal; parts thereof of base metal.
	83	Miscellaneous articles of base metal.
Sector 12	84	Nuclear reactors, boilers, machinery and mechanical appliances; parts thereof.
	85	Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television image and sound recorders and reproducers, and parts and accessories of such articles.
Sector 13	86	Railway or tramway locomotives, rolling-stock and parts thereof; railway or tramway track fixtures and fittings and parts thereof; mechanical (including electro-mechanical) traffic signalling equipment of all kinds.
	87	Vehicles other than railway or tramway rolling-stock, and parts and accessories thereof.
	88	Aircraft, spacecraft, and parts thereof.
	89	Ships, boats and floating structures.
Sector 14	90	Optical, photographic, cinematographic, measuring, checking, precision, medical or surgical instruments and apparatus; parts and accessories thereof.
	91	Clocks and watches and parts thereof.
	92	Musical instruments; parts and accessories of such articles.
Sector 15	93	Arms and Munitions etc.
Sector 16	94	Furniture; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings; lamps and lighting fittings, not elsewhere specified or included; illuminated signs, illuminated name-plates and the like; prefabricated buildings.
	95	Toys, games and sports requisites; parts and accessories thereof.
	96	Miscellaneous manufactured articles.

Appendix A2: Data Construction.

Imports

Table A2.1: Quantity Construction.

Tanzania 2004			
Industry	Industry Description	Trade (KG)	Qty
010111	Live pure bred breeding horses.	1874	
010119	Live horses, other than for pure-bred.	277	
010210	Live pure-bred breeding bovine animals.	3812	
010310	Live pure-bred breeding swine.	66	
010410	Live sheep.	199	
010420	Live goats.	15186	
010511	Live fowls.	234656	
010519	Live ducks, geese, and turkeys.	3442	
010600	Other live animals.	2331	
01	Live Animals (SUM)	261843	

Average Tariffs

Table A2.2: Average Tariff Construction.

Kenya 1994: Industry 05 Average Tariff		
Industry	Industry Description	Ad Valorem Tariff
05010000	Human hair.	50
05021000	Pigs', hogs' or boars' bristles and hair and waste thereof.	31
05030000	Horsehair and horsehair waste.	31
05040010	Sausage casings	31
05040090	Other guts bladders and stomachs of animals.	50
05051000	Feathers of a kind used for stuffing.	18
05061000	Ossein and bones treated with acid.	50
05071010	Ivory, elephant.	50
05071020	Teeth, hippopotamus.	50
05071030	Horn, rhinoceros.	50
05071040	Other ivory.	50
05071090	Ivory powder and waste.	50
05080000	Coral and similar materials.	50
05090000	Natural sponges of animal origin.	50
05100090	Bile.	31
05119110	Fish waste.	31
05119120	Fish ova.	12
05119190	Other products of fish or crustaceans.	31
05119920	Sinews and tendons.	50
05119990	Other animal products.	37
05 (Average)	Products of animal origin not elsewhere specified or included.	40.15

Appendix A3: Raw Results

OLS

Table A3.1: Raw Results OLS.

OLS	Algeria	Cameroon	CAR	Ethiopia	Egypt
P(1+t)	-1.204***	1.207***	-1.444***	-1.347***	-1.410***
	0.05	0.055	0.075	0.072	0.074
Constant	16.69***	14.94***	12.90***	14.71***	17.73***
	0.079	0.098	0.11	0.1	0.1
Observations	1116	938	718	649	564
R-squared	0.42	0.35	0.43	0.34	0.56

Notes: *** indicates significant at the 1 percent level

Table A3.2: Raw Results OLS (Continued).

OLS	Gabon	Kenya	Madagascar	Tanzania	Uganda
P(1+t)	-1.388***	-1.148***	-1.532***	-1.053***	-1.224***
	0.076	0.07	0.052	0.051	0.052
Constant	14.81***	15.93***	14.68***	14.81***	14.52***
	0.097	0.12	0.081	0.079	0.092
Observations	835	376	1121	940	1028
R-squared	0.36	0.45	0.51	0.29	0.33

Notes: *** indicates significant at the 1 percent level

Fixed Effects

Table A3.3: Raw Results Fixed Effects.

FE	Algeria	Cameroon	CAR	Ethiopia	Egypt
P(1+t)	-0.825***	-0.968***	-0.906***	-1.037***	-1.001***
	0.067	0.036	0.07	0.087	0.073
Constant	16.43***	14.71***	12.29***	14.51***	17.27***
	0.054	0.04	0.092	0.064	0.083
Observations	1116	938	718	649	564
R-squared	0.39	0.71	0.4	0.42	0.6
No of product	93	94	68	93	94

Notes: *** indicates significant at the 1 percent level

Table A3.4: Raw Results Fixed Effects (Continued).

FE	Gabon	Kenya	Madagascar	Tanzania	Uganda
P(1+t)	-1.072***	-0.817***	-0.970***	-0.816***	-0.948***
	0.064	0.053	0.067	0.03	0.039
Constant	14.45***	15.63***	14.00***	14.71***	14.32***
	0.068	0.056	0.08	0.023	0.042
Observations	835	376	1121	940	1028
R-squared	0.54	0.65	0.4	0.58	0.54
No of product	93	94	94	94	94

Notes: *** indicates significant at the 1 percent level

Sector Elasticities

Table A3.5: Raw Results Sector Elasticities.

	Algeria	Cameroon	CAR	Ethiopia	Egypt
Sector 1	-1.808*** 0.25	-3.266*** 0.31		-1.752*** 0.29	-0.174 0.32
Sector 2	-2.370*** 0.15	-1.562*** 0.12		-1.879*** 0.18	-2.372*** 0.17
Sector 3	-1.577*** 0.14	-1.135*** 0.091	-1.651*** 0.13	-1.309*** 0.13	-1.412*** 0.1
Sector 4	-1.338*** 0.1	-2.045*** 0.17	-1.265*** 0.29	-2.106*** 0.29	-1.534*** 0.071
Sector 5	-0.653*** 0.12	-0.705*** 0.12	-0.678*** 0.13	-0.664*** 0.18	-0.926*** 0.084
Sector 6	-2.261*** 0.31	-0.951*** 0.29	-1.128*** 0.28	-2.346*** 0.34	-2.569*** 0.28
Sector 7	-2.268*** 0.23	-1.940*** 0.42	-0.420** 0.2	-1.792*** 0.38	-2.520*** 0.48
Sector 8	-1.684*** 0.13	-1.980*** 0.17	-2.073*** 0.14	-1.144*** 0.23	-1.795*** 0.074
Sector 9	-1.987*** 0.16	-1.764*** 0.16	-2.048*** 0.14	-1.439*** 0.19	-2.546*** 0.25
Sector 10	-1.150*** 0.025	-1.543*** 0.12	-1.066*** 0.17	-1.196*** 0.39	-1.074*** 0.04
Sector 11	-1.729*** 0.15	-1.728*** 0.13	-2.057*** 0.12	-2.050*** 0.17	-1.855*** 0.14
Sector 12	0.874*** 0.064	0.438*** 0.069	0.408*** 0.08	1.344*** 0.17	0.436*** 0.084
Sector 13	-0.777*** 0.069	-0.873*** 0.053	-0.730*** 0.16	-0.996*** 0.15	-1.727*** 0.25
Sector 14	-1.118*** 0.24	-1.346*** 0.2	-1.339*** 0.23	-0.782*** 0.22	-1.094*** 0.24
Sector 15		-1.206*** 0.096	-0.390*** 0.085	-0.760*** 0.12	-2.071*** 0.19
Sector 16	-0.225 0.15	-0.666*** 0.12	-1.174*** 0.13	-0.375** 0.18	-1.180*** 0.071
Constant	16.74*** 0.079	15.02*** 0.11	12.85*** 0.13	14.54*** 0.12	17.90*** 0.1
Observations	1116	938	718	649	564
R-squared	0.55	0.48	0.59	0.45	0.71

Notes: *** indicates significant at the 1 percent level

Table A3.5: Raw Results Sector Elasticities (Continued).

	Gabon	Kenya	Madagascar	Tanzania	Uganda
Sector 1	-1.352***	-1.582***	-2.109***	-2.042***	-2.210***
	0.18	0.44	0.12	0.19	0.21
Sector 2	-2.106***	-1.506***	-2.449***	-2.320***	-1.953***
	0.13	0.17	0.1	0.21	0.2
Sector 3	-1.035***	-0.991***	-1.251***	-1.086***	-0.842***
	0.12	0.11	0.093	0.17	0.081
Sector 4	-0.741**	-1.321***	-2.473***	-0.818***	-1.708***
	0.34	0.48	0.28	0.3	0.47
Sector 5	-0.693***	-0.531***	-0.612***	-0.752***	-0.159
	0.1	0.14	0.075	0.15	0.11
Sector 6	-2.388***	-2.822***	-2.298***	-1.410***	-1.502***
	0.25	0.58	0.19	0.54	0.57
Sector 7	-1.775***	-1.538***	-1.496***	-0.743***	-1.242***
	0.3	0.35	0.21	0.15	-0.24
Sector 8	-2.185***	-1.757***	-1.354***	-1.498***	-2.039***
	0.15	0.2	0.14	0.18	0.19
Sector 9	-1.828***	-2.421***	-2.246***	-2.222***	-1.237***
	0.11	0.39	0.14	0.29	0.27
Sector 10	-1.094***	-1.285***	-1.296***	-1.340***	-1.307***
	0.17	0.029	0.028	0.056	0.047
Sector 11	-2.087***	-1.933***	-2.098***	-1.539***	-1.900***
	0.14	0.21	0.11	0.18	0.17
Sector 12	0.479***	0.219*	0.560***	1.416***	0.459**
	0.1	0.12	0.071	0.16	0.19
Sector 13	-0.625***	-0.882***	-0.799***	-0.582***	-0.928***
	0.069	0.13	0.094	0.074	0.085
Sector 14	-0.956***	-2.005***	-0.906***	-0.902***	-1.340***
	0.19	0.26	0.15	0.28	0.25
Sector 15	-0.993***	-0.625***	-1.917***	-1.665***	-1.510***
	0.048	0.23	0.12	0.064	0.13
Sector 16	-0.840***	-0.947***	-0.723***	-0.292	-0.566***
	0.11	0.11	-0.084	0.22	0.12
Constant	15.00***	16.11***	14.60***	14.76***	14.54***
	0.11	0.15	0.088	0.088	0.11
Observations	835	376	1121	940	1028
R-squared	0.54	0.57	0.66	0.4	0.43

Notes: *** indicates significant at the 1 percent level

Industry Elasticities

Table A3.6: 96 Industry Elasticities.

Sector	Algeria	Cameroon	CAR	Ethiopia	Egypt
1	-0.637***	-2.866***		-1.844***	-0.285
2	0.433	-2.387***		-2.995***	1.874***
3	-3.461***	-4.104***		-4.723***	-3.338***
4	4.869***	2.475***		0.294	1.193***
5	-2.834***	-4.134***		1.395***	0.94
6	-2.543***	-1.172***		-1.575***	-2.630***
7	-4.135***	-0.709**		-1.337**	-3.947***
8	-2.683***	-0.948		0.193	0.0576
9	2.459***	-2.707***		-1.768	1.276***
10	-3.269***	-3.916***		-3.346***	-3.141***
11	-3.128***	-6.021***		-2.639***	-1.113***
12	-1.441***	-0.938***		-1.144***	-2.991***
13	-1.838***	-0.805***		-1.497***	-1.676***
14	2.727***	-5.143***		-1.534	-4.121***
15	-7.012***	-2.341		-4.938***	-8.655***
16	-1.184***	-0.169	-0.0653	-1.401***	-0.809***
17	-3.836***	-5.888***	-3.036***	-1.991***	-3.315***
18	-1.679***	-2.236***	-2.115***	-2.173***	-3.111***
19	-0.725***	0.779**	0.718*	-1.527	-1.123***
20	-1.820***	1.831***	0.0188	-0.426	-2.477***
21	0.723***	1.873***	0.602***	-0.643	-0.776***
22	-1.542***	-1.212	-1.347	0.0727	-1.195***
23	-2.576***	-2.756***	-1.192	-2.662***	-2.704***
24	-1.125***	-1.241***	-2.154***	-1.318***	0.375**
25	-1.844***	-2.207***	-2.122***	-1.522***	-1.625***
26	-0.898***	0.0107		-3.240***	-1.723***
27	-2.192***	-3.954***	-0.852*	-3.965***	-2.088***
28	-3.164***	-3.836***	-3.266***	-2.857***	-3.366***
29	3.294***	1.425***	-0.861***	-0.621	1.274***
30	0.409***	0.255***	0.249***	0.452***	-0.522***
31	-1.548***	-2.638***	-1.503***	-2.610***	-1.076***
32	0.961***	0.740***	0.105	1.717***	1.973***
33	-0.281	0.366***	0.108	0.271**	-0.944***
34	-0.349	1.526***	-0.546	-4.195***	-0.471*
35	-0.977***	-0.138	-1.148***	0.23	-1.235***
36	-1.659***	-1.170***	-1.049***	-0.0629	-2.980***
37	-0.681***	-0.740***	-1.485***	-0.466***	-0.816***
38	2.637***	1.543***	0.255**	1.200***	0.725***
39	4.674***	3.780***	1.366***	-2.445	4.756***
40	1.725***	0.247*	0.704***	3.303***	0.696***
41	-1.492***	-2.172***		-4.502***	-2.041***
42	-1.419***	-0.341***	-1.792***	-0.759***	-2.007***
43	-3.110***	-7.994***		-2.572***	-3.173***
44	-3.574***	-1.747***	-1.529***	-2.661***	-1.861
45	-3.445***	-3.769***		-2.935***	-4.210***
46	-1.363	-4.406***		-3.520***	-6.278***
47	-1.601***	-0.254		-1.669***	-1.243***
48	-3.481	1.293	1.732***	-2.286**	1.402
49	-0.754***	0.141	-0.112	0.0231	-1.029***
50	-3.076***	-3.447***		-3.238***	-1.899***
51	-1.741***	-4.454***	-0.984	-3.499***	-1.240***
52	1.085***	-0.548***	-0.471**	-0.948***	-0.133
53	-1.821	-3.748***	-3.810***	-0.985***	-0.819

54	0.643**	-0.665***	-1.970***	0.592	0.493**
55	1.086***	0.00305	-1.305***	1.981***	0.534**
56	-1.285***	-0.429***	-1.240***	-0.647***	-1.270***
57	-1.901***	-1.289***	-2.606***	-0.922***	-1.775***
58	-1.406***	-1.910***	-2.110***	-0.897***	-1.620***
59	-1.259***	-1.142***	-1.829***	-0.111	-1.182***
60	-0.620***	-2.294***		-1.911***	-2.043***
61	-1.050***	-0.683***	-1.395***	0.196	-1.928***
62	-1.088***	-0.765***	-1.117***	0.535**	-1.556***
63	-0.211	5.218***	3.538***	1.682***	-2.836***
64	-0.797***	-0.0813	-0.607***	1.124***	-1.269***
65	-1.515***	-1.487***	-1.962***	-1.392***	-2.209***
66	-3.585***	-1.742***	-1.980***	-0.793***	-4.005***
67	-3.622***	-2.798***	-1.488***	-1.935***	-2.816***
68	-0.78	0.214	-0.920***	0.544*	-1.109**
69	-1.960***	-0.579	-0.812**	-2.156***	0.266
70	-2.627**	-0.439	0.569*	-3.107***	-4.044***
71	-1.078***	-1.418***			-1.018***
72	-4.210***	-4.024***	-2.315**	-4.527***	-4.006***
73	5.779***	2.742***	1.271***	-4.671*	2.667***
74	0.462**	-1.310***	-1.853***	-0.748**	-0.109
75	-2.232***	-1.778***		-2.526***	-2.131***
76	0.775***	0.00772	0.364	0.421	-0.396**
78	0.821**	-2.671***	-2.410***	-1.629***	1.470*
79	-3.973***	0.111	-2.537***	-1.537*	-2.417***
80	-2.575***	-3.187***	-2.447***	-2.615***	-2.455***
81	-2.195***	-1.533***	-2.108***	-2.381***	-1.952***
82	-0.0891	0.007	-0.0244	0.647**	-0.621***
83	0.0544	0.787***	-0.107	1.417***	-0.541***
84	1.304***	0.720***	0.872***	1.674***	0.862***
85	1.052***	0.823***	0.598***	1.496***	0.548***
86	-0.104	-0.460***	-0.507	-0.864**	-1.087***
87	1.334***	0.515***	1.910***	2.397***	0.611***
88	-0.773***	-0.825***	-0.887***	-0.803***	-2.601***
89	-0.972***	-0.888***		-2.730***	-1.302***
90	-0.105**	-0.248***	-0.283***	0.097	-0.347***
92	-2.628***	-1.889***	-2.161***	-1.460***	-2.085***
93		-0.773***	-0.158	0.752***	-0.721***
94	-0.488***	0.321*	-1.444***	-0.888***	-0.717***
95	-1.062***	-0.530***	-0.869***	-0.0554	-0.940***
96	-0.0346	-0.423***	-0.00396	-0.589***	-1.854***
Constant	16.06***	14.19***	12.13***	14.08***	17.29***
Observations	1116	938	718	649	564
R-Squared	0.83	0.8	0.79	0.72	0.91

Notes: *** indicates significant at the 1 percent level

Table A3.6: 96 Industry Elasticities (Continued).

Sector	Gabon	Kenya	Madagascar	Tanzania	Uganda
1	-1.360***	-2.557***	-1.522***	-1.414***	-1.795***
2	6.087***	-3.140***	-3.158***	-2.782***	-3.445***
3	-2.68	-0.403	-2.668***	-3.128***	-2.026***
4	2.735***	-0.625**	0.863***	-1.772***	-0.103
5	-7.873**	0.928***	-2.139***	-2.681***	-1.964***
6	-2.021***	-1.006***	-2.475***	-1.422***	-1.048***
7	-2.797***	-1.599***	-1.136	-2.154***	-1.983***
8	-0.896**	-0.505	-2.790***	-0.232	-1.056
9	-1.744***	-2.404***	-1.815***	0.0252	-1.779***
10	-3.140***	-3.403***	-3.720***	-3.452***	-4.341***
11	-4.897***	-1.365**	-3.157***	-3.006***	-5.767***
12	-1.146***	-0.743***	-1.607***	-1.693***	-0.927***
13	-1.327***	-1.145***	-1.528***	-1.525***	-1.931***
14	-2.777***	-4.48	-2.808***	-3.397***	-2.154**
15	2.772**	-4.506***	-5.363***	-5.370***	-3.595***
16	1.333***	-2.175***	-1.422***	-1.947***	-1.632***
17	-1.636***	-2.788***	-3.171***	-4.001***	-5.250***
18	-1.098***	-1.374***	-1.714***	-1.496**	-1.268***
19	1.953***	-0.664**	-0.361	0.0723	0.177
20	2.245	-1.357***	-1.810***	-0.918***	-0.661*
21	0.992***	-0.496***	-0.157	0.295***	0.373
22	7.142***	-1.146***	-0.955***	-2.013***	-1.333***
23	-1.889***	-0.939***	-1.962***	-0.967***	-0.271**
24	-1.850***	-0.841***	-1.063***	-1.080***	-0.821***
25	-1.844***	-1.289***	-1.784***	-1.661***	-2.879***
26	-0.375	-0.436***	-3.089***	0.721*	-0.785
27	-0.358	-4.571***	-5.173***	-0.689	-0.881
28	-3.405***	-3.915***	-1.322	-2.185***	-4.276***
29	0.151	1.199***	0.273**	-0.21	0.639**
30	0.0843	-0.0304	0.0508	0.531***	0.911***
31	-0.987***	-2.937***	-2.249***	-2.605***	-2.643***
32	0.367	0.0229	0.0873	0.446**	0.269
33	0.0928	-0.405***	-0.168	0.876***	0.343**
34	-1.393*	-0.421**	0.398	-0.972***	1.570***
35	-1.010***	-1.013***	-0.772***	-0.738***	-0.932***
36	-0.981***	-1.313***	-1.441***	0.356**	0.673**
37	-1.013***	-0.177	-0.794***	-0.784***	-0.535***
38	1.143***	1.055***	0.694***	1.052	0.831***
39	1.868***	3.613***	2.520***	-5.627	3.877***
40	0.539***	2.621**	0.932***	2.404***	1.596***
41	-2.638***	-2.448***	-2.230***	-0.823	-1.806**
42	-0.786***	-1.273***	-0.716***	-0.065	0.676***
43	-3.252***	-4.286***	-2.825***	-2.394***	-3.318***
44	-0.999***	-0.936***	-1.468***	-1.260***	-1.336***
45	-2.789***	-4.148***	-2.538***	0.726	-2.606***
46	-3.385***	-4.076***	-2.858***	-2.138***	-3.984***
47	-8.830***	1.184	-0.489***	-0.731***	0.608
48	1.810***	-2.952	2.394***	1.633	-0.979
49	-0.172**	0.483**	-0.0493	0.391***	0.203**
50	-2.671***	-3.750***	-1.490***	-3.395***	-2.954***
51	-2.863***	-2.773***	-1.201***	-3.030**	-2.522***
52	-1.094***	0.859**	0.453**	0.890***	-0.854***
53	-3.038***	2.896***	-1.856***	-0.847	-2.840***
54	-2.076***	-0.448	0.480***	-0.1	-0.624**
55	-1.480***	1.313***	0.310*	0.324	0.836*

56	-0.768***	-1.083***	-1.252***	0.448*	-0.387*
57	-1.296***	-1.267***	-1.705***	-1.443***	-1.403***
58	-1.914***	-1.711***	-0.886***	-1.786***	-1.504***
59	-1.093***	-0.756***	-1.212***	-0.947***	-2.044***
60	-2.990***	-2.000***	-0.377	-1.464***	-2.098***
61	-0.714***	-1.055***	-0.827***	-0.184	0.308
62	-0.398***	-0.655***	-0.592***	0.313	0.101
63	1.421***	3.049	0.573	-5.209***	7.129***
64	-0.247	-0.726***	0.388*	0.899	0.993***
65	-1.408***	0.109	-2.094***	-1.530***	-0.972***
66	-1.910***	-3.050***	-1.846***	-3.034***	-2.213***
67	-1.711***	-2.972***	-2.420***	-3.546***	-1.740***
68	-0.033	-0.621***	-0.524***	-1.733***	-0.629**
69	-3.770***	1.147*	-2.469***	-2.659***	-2.109***
70	0.847	0.605	-0.333	-2.182***	-2.238
71		-1.256***	-1.242***	-1.223***	-1.233***
72	-4.686***	-5.785***	-4.738***	-4.870***	-3.337***
73	1.566	0.863***	1.448***	1.326	3.256***
74	-1.173***	-0.837***	-1.282***	-0.564**	-1.216***
75	-2.255***	-2.247***	-2.223***	-2.000***	-2.398***
76	0.368	0.0494	0.00944	0.999***	0.834***
78	-3.516***	-1.472	-3.307***	-2.614	-1.552*
79	-2.593***	0.643*	-1.361***	0.104	-0.67
80	-3.256***	-2.548***	-2.545***	-1.157***	-2.679***
81	-2.262***	-2.752***	-2.541***	-2.107***	-2.912***
82	-0.433**	-1.505	-0.307***	1.909***	0.187
83	-0.0102	-0.284*	0.00566	-0.0239	-1.532***
84	1.312***	0.142**	0.836***	1.580***	0.652***
85	0.569***	1.488***	0.818***	1.846***	0.526
86	-0.0952	-1.339***	-0.704	-0.05	-0.971***
87	1.256***	0.695***	1.665***	1.169***	0.626***
88	-0.557***	-0.592***	-0.896***	-0.642***	-0.879***
89	-4.811***	-1.368***	-0.782***	-0.695***	-1.118***
90	-0.150**	-0.778	-0.254***	0.302***	0.0599
92	-1.765***	-1.961***	-1.766***	-1.804***	-1.753***
93	0.465***	0.00788	-1.774***	-1.476***	-1.372***
94	-0.701***	-0.787***	-0.18	1.086***	0.246**
95	-0.665***	-1.230***	-0.580***	-0.487***	-0.616***
96	-0.719***	-0.449	-0.356***	-0.941***	-1.424***
Constant	14.13***	15.76***	14.00***	14.28***	14.06***
Observations	835	376	1121	940	1029
R-Squared	0.83	0.87	0.84	0.62	0.63

Notes: *** indicates significant at the 1 percent level.